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- **Sample Papers for Self Evaluation**

By

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PREFACE

We've designed Golden® **Mathematics IX** as a learning resource to simplify the concepts of mathematics for CBSE students. This book is based on the new **NCERT Textbook** for Grade 9 Mathematics— **GANITA MANJARI**. In addition to the relevant theories and examples, the book provides solutions to the **Think and Reflect Sections**, **Exercise Sets** and **End-of-Chapter Exercises** given in **GANITA MANJARI**.

This study material of Mathematics will help students develop effective problem solving approaches and gain mastery in solving Mathematical questions.

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- Subjective Exercises
- Case Study Based Questions

We hope that our efforts will prove fruitful in developing mathematical competence of Grade 9 students. We welcome feedback and suggestions from teachers, students and parents.

AUTHORS

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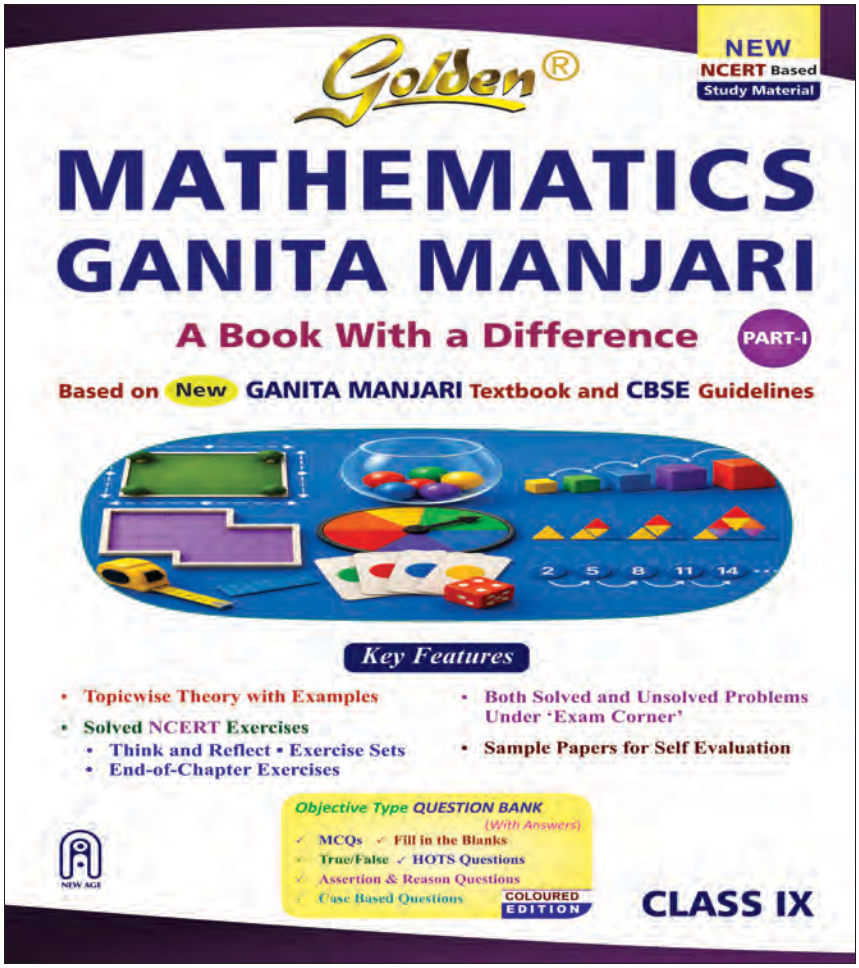

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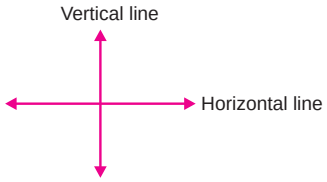
Orienting Yourself : The Use of Coordinates

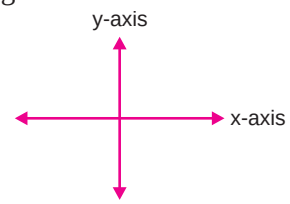
CHAPTER 1

1.1 INTRODUCTION

- To locate the position of an object (or a point) in a plane, two perpendicular lines are required, one of which is horizontal line and the other is vertical line.

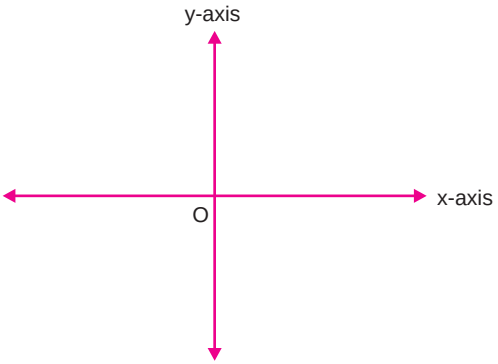


- The horizontal line is called the *x*-axis, and the vertical line is called the *y*-axis. These are together called *coordinate axes*.

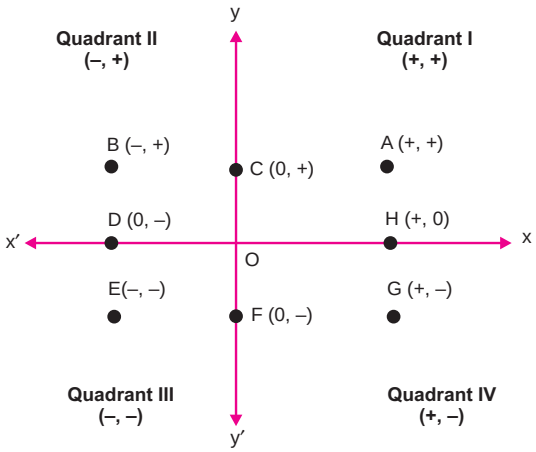


1.2/1.3 SETTLING IN/THE 2-D CARTESIAN COORDINATE SYSTEM

- The plane containing these lines is called the *cartesian plane* or *coordinate plane* or *xy-plane.*



- The point of intersection of the *x*-axis and the *y*-axis is called the origin. It is represented by *O*.
- The coordinate axes (*i.e.*, the *x*-axis and *y*-axis) divide the Cartesian plane into 4 quadrants. These are numbered as I, II, III and IV in anticlockwise as shown in the figure.



- The *x*-coordinate of a point is also called its abscissa.
- The distance of a point from the *y*-axis is the magnitude of its *x*-coordinate (abscissa).
- If the point is to the right of the origin, the sign of the abscissa is taken as positive.
  If the point is to the left of the origin, the sign of the abscissa is taken as negative.
  If the point is on the *y*-axis, its abscissa is 0 because its distance from *y*-axis is 0.

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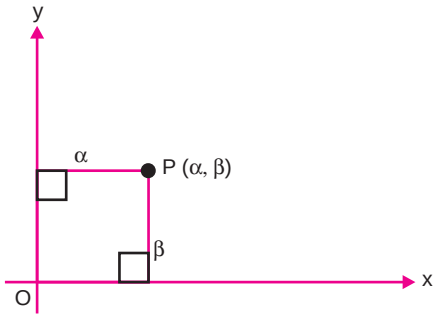
- *y*-coordinate of a point is called its ordinate.
- Distance of a point from *x*-axis is the magnitude of its *y*-coordinate (ordinate).

  If the point is above *x*-axis, the sign of ordinate is taken as positive.

  If the point is below *x*-axis, the sign of ordinate is taken as negative.

  If the point is on *x*-axis, its ordinate is 0 because its distance from *x*-axis is 0.
- Any point in the plane can be represented by ordered pair (x, y), where x is *x*-coordinate or abscissa and y is *y*-coordinate or ordinate.

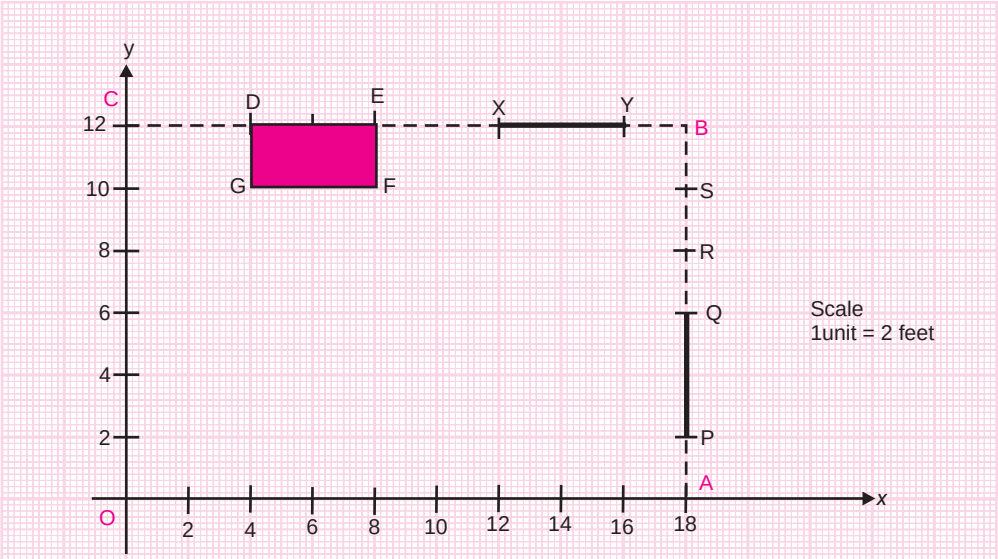
  In the given figure, coordinates of point *P* are (α, β).



- Coordinates of origin are (0, 0).
- Point (x, y) is different from point (y, x).
- To find coordinates of a point we drop perpendiculars to *x*-axis and *y*-axis from it. The foot of perpendicular to *x*-axis is *x*-coordinate and the foot of the perpendicular to *y*-axis is *y*-coordinate.

SOLVED EXAMPLES

Example 1: The given figure shows Tanya's room with points OABC marking its corners. The x- and y-axes are marked in the figure. Point O is the origin.



Answer the following Questions:

(*a*) If *PQ* represents a door, how far is it from the left wall (the *y*-axis) of the room? How far is the door from the *x*-axis?

(*b*) If *RS* represents a window, how far is it from the left wall (the *y*-axis) of the room? How far is the window from the *x*-axis?

(*c*) *DEFG* is a wardrobe. What are its dimensions?

(*d*) What are the co-ordinates of the exact centre point of the room?

Solution:

(*a*) 18 feet from left wall (*y*-axis), 2 feet from *x*-axis.

(*b*) 18 feet from left wall (*y*-axis), 8 feet from *x*-axis.

(*c*) The wardrobe is 4 ft × 2 ft.

(*d*) $C\left(\frac{18}{2}, \frac{12}{2}\right)$ or C (9, 6).

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NCERT EXERCISE SET 1.1 (*Pages 4–5*)

The figure below shows Reiaan's room with points OABC marking its corners. The x- and y-axes are marked in the figure. Point O is the origin.

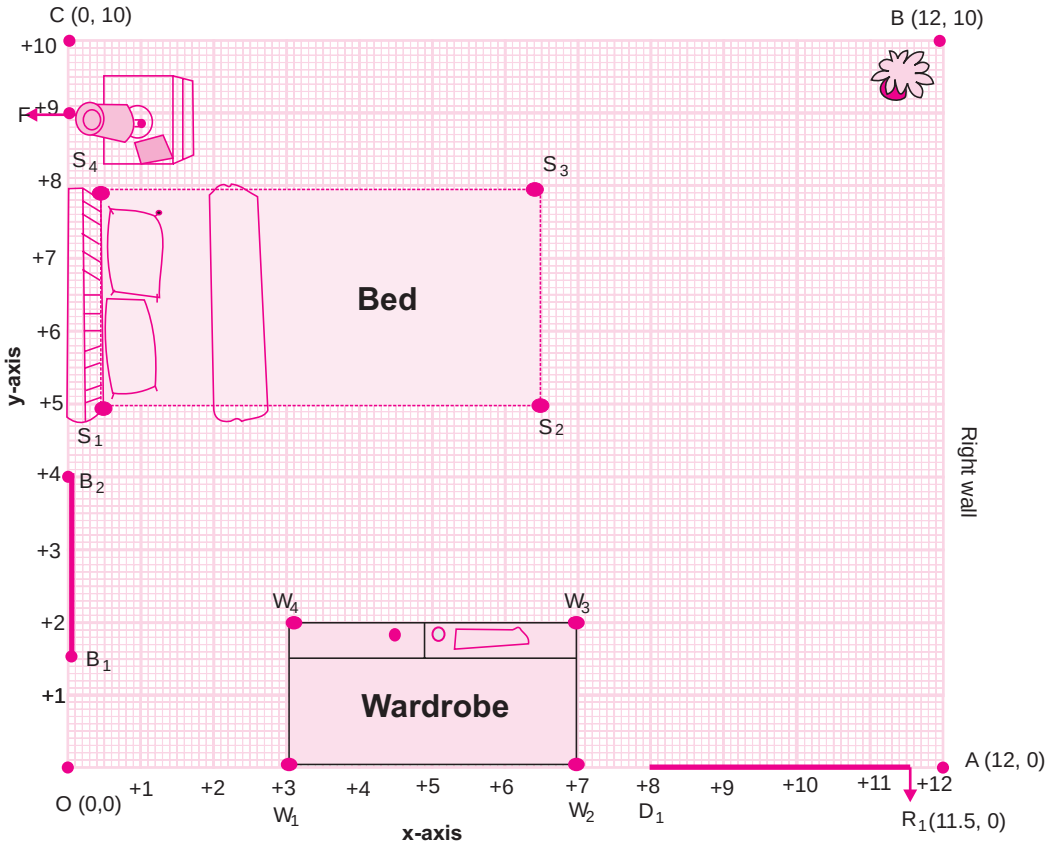


Fig.

Referring to the above figure, answer the following questions:

(*i*) If D_1R_1 represents the door to Reiaan's room, how far is the door from the left wall (the *y*-axis) of the room? How far is the door from the *x*-axis?

(*ii*) What are the coordinates of D_1?

(*iii*) If R_1 is the point (11.5, 0), how wide is the door? Do you think this is a comfortable width for the room door? If a person in a wheelchair wants to enter the room, will he/she be able to do so easily?

(*iv*) If B_1 (0, 1.5) and B_2 (0, 4) represent the ends of the bathroom door, is the bathroom door narrower or wider than the room door?

Solution:

(*i*) The door starts at D_1 (x = 8) and ends at R_1 (x = 11.5). Therefore, the door is 8 units away from the left wall at its nearest point. Since the door lies exactly on the *x*-axis, its distance from the *x*-axis is 0 units.

(*ii*) The point D_1 is located at 8 on the *x*-axis and 0 on the *y*-axis. Hence coordinates of D_1 (8, 0).

(*iii*) Width of door = $R_1 - D_1$

= (11.5 – 8) units = 3.5 units.

Whether this is **Comfortable** depends on the scale of the units (*e.g.* meters *vs* feet). If 1 unit represent 1 meter it is standard. If it represents 1 foot it is not comfortable and a person in a wheelchair would not be able to enter easily as a wheelchair typically requires a minimum width of 0.8-0.9 m.

(*iv*) Width of the bathroom door between B_1 (0, 1.5) and B_2 (0, 4) = (4 – 1.5) units = 2.5 units.

Since 2.5 < 3.5. Hence, the bathroom door is narrower than the room door.

THINK AND REFLECT (*Page 5*)

1. ***What are the standard widths for a room door? Look around your home and in school.***

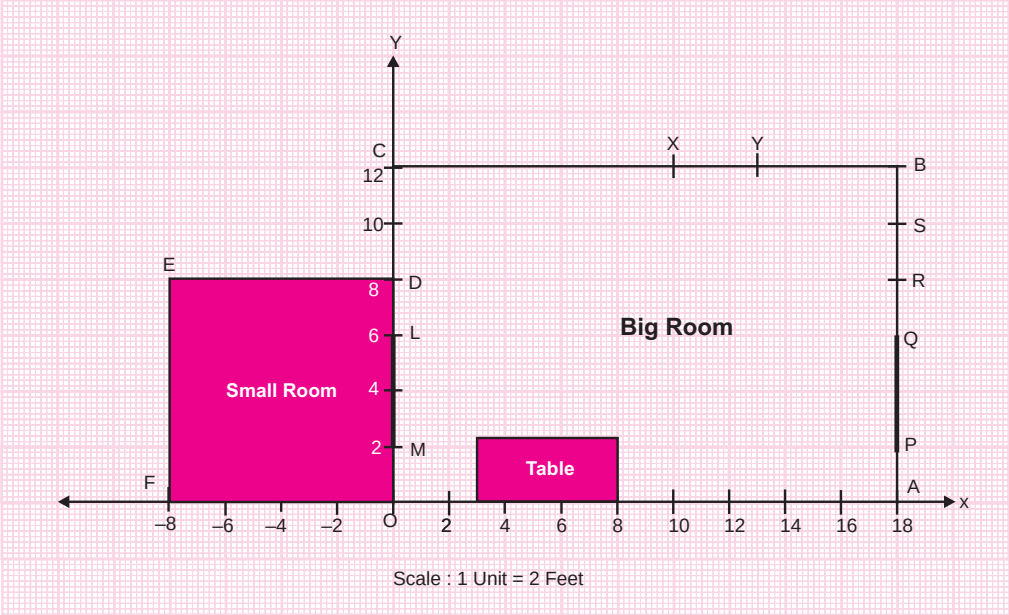
Sol. According to the National Building Code of India (NBC 2016), the standard width of room doors ranges between 686 mm (= 2.25 ft) and 1067 mm (= 3.5 ft).

2. ***Are the doors in your school suitable for people in wheelchairs?***

Sol. Students, measure the doors in your school. If they are at least 3 ft wide, they are suitable for wheelchairs. If they are narrower, they are not.

SOLVED EXAMPLES

Example 1: The given figure shows two adjoining rooms. One big and one small. The x- and y-axes are marked in the figure. Point O is the origin.



Answer the following questions:

(*a*) What are the coordinates of the corners of the small room?

(*b*) *LM* is a door between the two rooms. What are the coordinates of *L* and *M*? How wide is this door?

(*c*) Door *LM* is hinged at *M* and opens in the big room. Will it hit the table as it opens?

Solution:

(*a*) O (0,0), *D* (0, 8); *E* (–8, 8) and *F* (–8, 0).

(*b*) *L* (0, 6), *M* (0, 2). This door is 4 feet wide.

(*c*) Yes; The table is 3 feet from the door, which is 4 feet long.

THINK AND REFLECT (*Page 7*)

1. ***What is the x-coordinate of a point on the y-axis?***

Sol. On the *y*-axis, the *x*-coordinate is always 0.

2. ***Is there a similar generalisation for a point on the x-axis?***

Sol. Yes, on the *x*-axis, the *y*-coordinate is always 0.

3. ***Does point Q (y, x) ever coincide with point P(x, y)? Justify your answer.***

Sol. For general values of *x* and *y*, the points are different.

They coincide only when $x = y$.

Example: If $x = 2$ and $y = 2$,

then P (2, 2) and Q (2, 2) are the same points.

4. *If $x \neq y$, then $(x, y) \neq (y, x)$; and $(x, y) = (y, x)$ if and only if $x = y$. Is this claim true?*

Sol. Yes, this claim is true.

Ordered pairs are equal only when both corresponding coordinates are equal.

So, $(x, y) = (y, x)$ happens only if $x = y$.

If $x \neq y$. then the two ordered pairs represent different points.

NCERT EXERCISE SET 1.2 (*Pages* 7–8)

On a graph sheet, mark the x-axis and y-axis and the origin O. Mark points from (–7, 0) to (13, 0) on the x-axis and from (0, –15) to (0, 12) on the y-axis. (Use the scale 1 cm = 1 unit.) Using the given figure, answer the given questions.

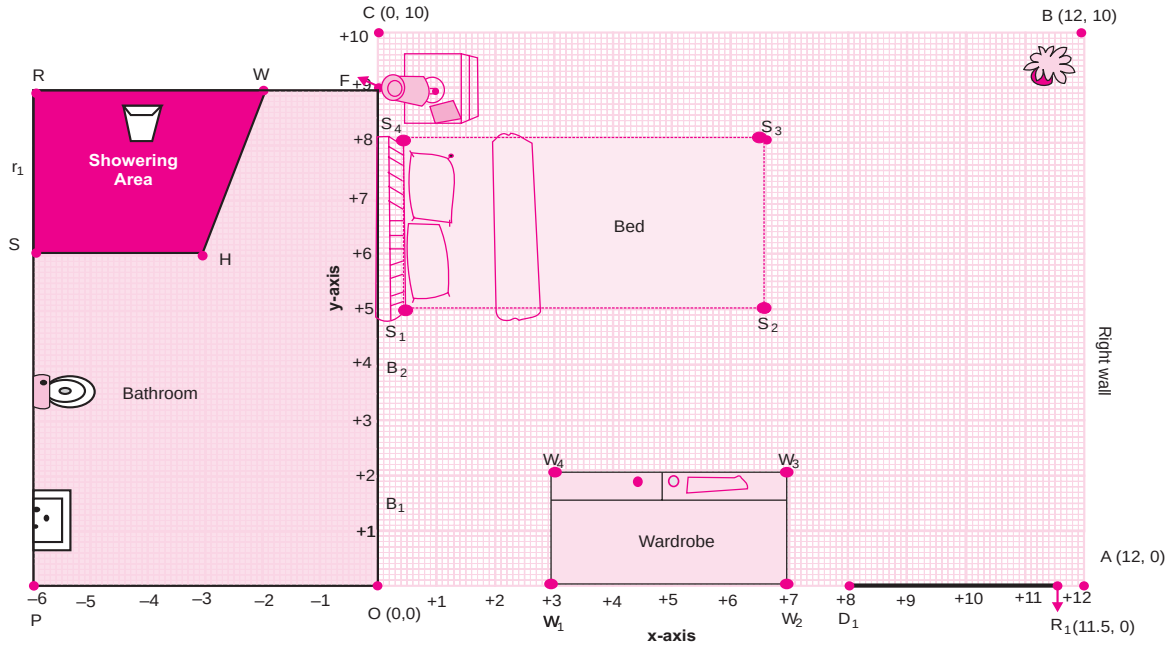


Fig.

1. *Place Reiaan's rectangular study table with three of its feet at the points (8, 9), (11, 9) and (11, 7).*

(*i*) Where will the fourth foot of the table be?

(*ii*) Is this a good spot for the table?

(*iii*) What is the width of the table? The length? Can you make out the height of the table?

Sol. (*i*) Since the table is rectangular, the fourth foot must align vertically with (8, 9) and horizontally with (11,7). The coordinates are (8, 7). Hence, the fourth foot is at (8, 7).

(*ii*) No, this is likely not a good spot. According to the points it is placed 1 unit from the wall, somewhere middle in the plane.

(*iii*) Length: The horizontal distance between (8, 9) and (11, 9) = 11 – 8 = 3 units.

Width: The vertical distance between (11, 7) and (11, 9) = 9 – 7 = 2 units.

No, the height cannot be determined. This is a 2D floor plan representing the floor area (length and width).

2. *If the bathroom door has a hinge at B_1 and opens into the bedroom, will it hit the wardrobe? Are there any changes you would suggest if the door is made wider?*

Sol. *See figure above.*

Width of the bathroom door (B_1B_2)

= (4 – 1.5) units = 2.5 units.

The distance of B_1 from the wardrobe is 3 units.

2.5 < 3. Hence, the door will open without hitting the wardrobe.

No change in the position is required.

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3. ***Look at Reiaan's bathroom.***

(*i*) What are the coordinates of the four corners *O*, *F*, *R*, and *P* of the bathroom?

(*ii*) What is the shape of the showering area SHWR in Reiaan's bathroom? Write the coordinates of the four corners.

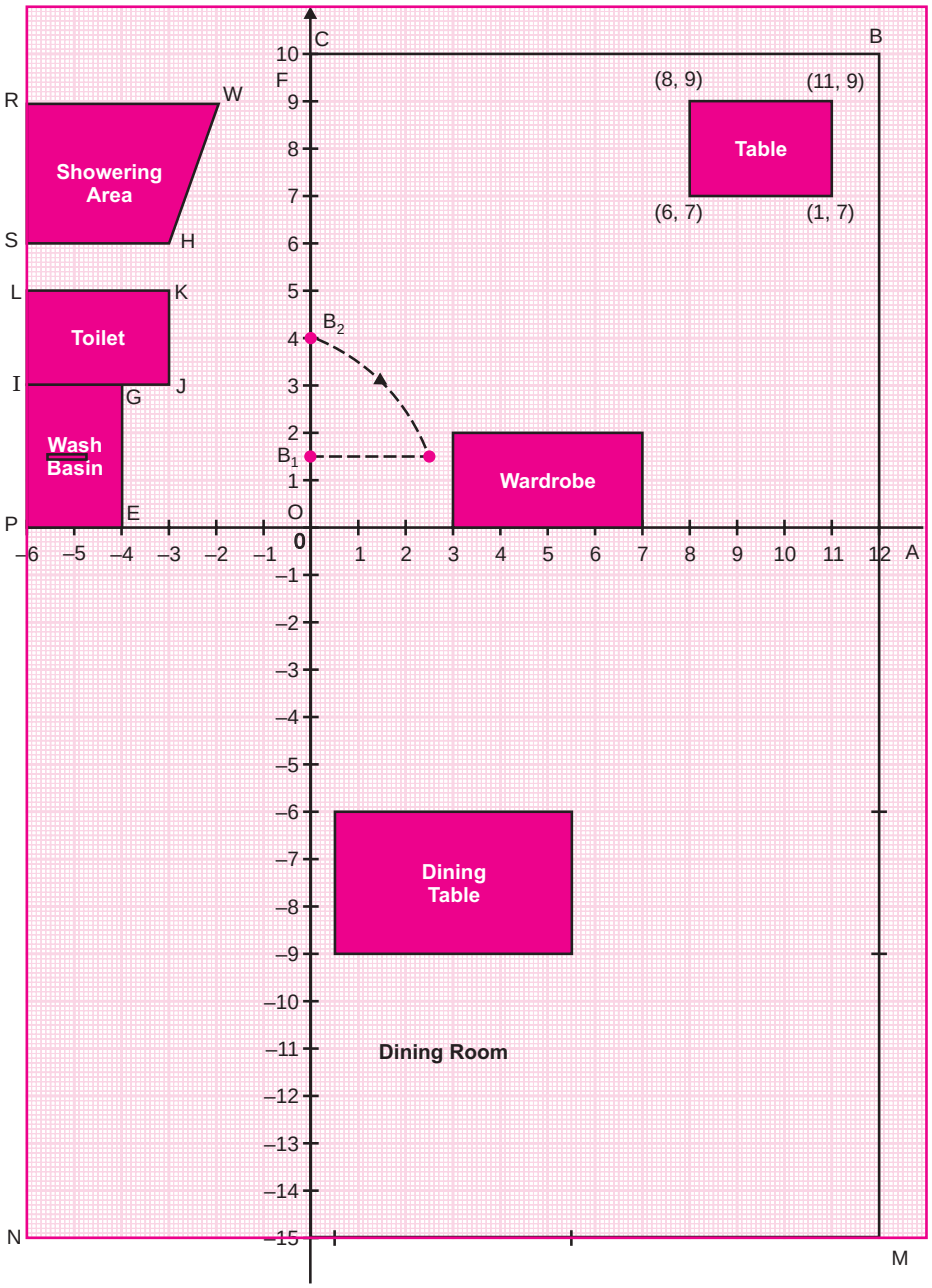
(*iii*) Mark off a 3 ft × 2 ft space for the washbasin and a 2 ft × 3 ft space for the toilet. Write the coordinates of the corners of these spaces.

Sol. (*i*) The bathroom is on the **left side** of the bedroom. Since it is on the left, its *x*-values are negative. Because it is above the *x*-axis, its *y*-values are positive. That means the bathroom is in the **second quadrant** of the coordinate plane. *O* (0, 0), *F* (0, 9), *R* (–6, 9), and P (–6, 0).

(*ii*) The showering area is in the shape of a trapezium.

S (–6, 6), *H* (–3, 6), *W* (–2, 9), *R* (–6, 9)

(*iii*) See figure below.



Washbasin: *PEGI*

P (–6, 0), *E* (–4, 0), *G* (–4, 3), *I* (–6, 3)

Toilet: *IJKL*

I (–6, 3), *J* (–3, 3), *K* (–3, 5), *L* (–6, 5)

4. *Other rooms in the house:*

(*i*) Reiaan's room door leads from the dining room which has the length 18 ft and width 15 ft. The length of the dining room extends from point *P* to point *A*. Sketch the dining room and mark the coordinates of its corners.

(*ii*) Place a rectangular 5 ft × 3 ft dining table precisely in the centre of the dining room. Write down the coordinates of the feet of the table.

Sol. (*i*) Point ***P* (–6, 0)** marks the bottom-left corner of the bathroom. From there, the dining room stretches downward, below the *x*-axis.

Because it extends below Reiaan's room:

- On the **left side** (–*x*, –*y*), it falls in **Quadrant III**.
- On the **right side** (+*x*, –*y*), it falls in **Quadrant IV**.

Coordinates of the corners:

P (–6, 0), *A* (12, 0), *M* (12, –15) and *N* (–6, –15).

See figure above.

(*ii*) The dining room centre is halfway along both length and width.

Midpoint of *x*: $\frac{(-6 + 12)}{2} = \mathbf{3}$

Midpoint of *y*: $\frac{(0 + (-15))}{2} = \mathbf{-7.5}$

So, centre = (3, –7.5).

The table size is **5 ft × 3 ft**.

Half-length = 2.5 ft, half-width = 1.5 ft.

1. Spread these around the centre:

Left $x = 3 - 2.5 = \mathbf{0.5}$

Right $x = 3 + 2.5 = \mathbf{5.5}$

Top $y = -7.5 + 1.5 = \mathbf{-6}$

Bottom $y = -7.5 - 1.5 = \mathbf{-9}$

So, the four feet of the table are at:

(0.5, –6), (5.5, –6), (5.5, –9), (0.5, –9)

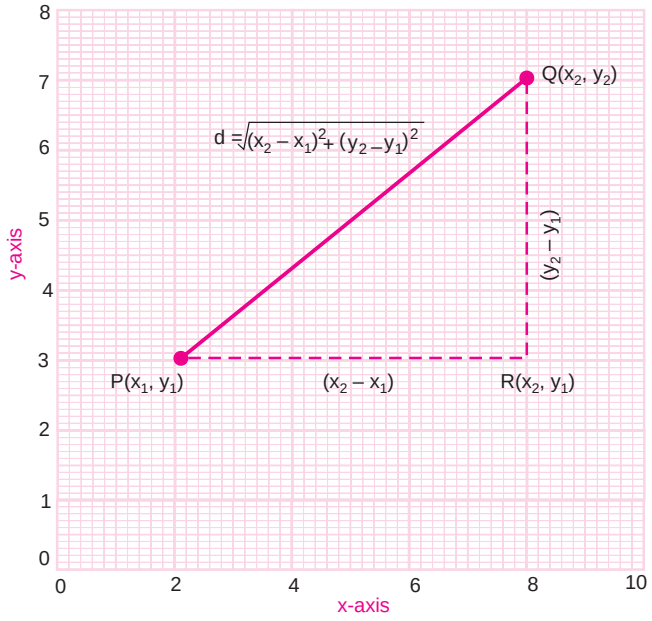
- Dining Room Corners :
(–6, 0), (12, 0), (12, –15), (–6, –15).
- Dining Table Feet:
(0.5, –6), (5.5, –6), (5.5, –9), (0.5, –9)

1.4 DISTANCE BETWEEN TWO POINTS IN THE 2-D PLANE

1. Distance Formula: In coordinate geometry, it is often required to find the distance between two points in a plane.

Let $P(x_1, y_1)$ and $Q(x_2, y_2)$ be two points.

Draw a perpendicular from point *Q* to the horizontal line through point *P*, meeting it at point *R*. Then triangle *PRQ* is a right-angled triangle at *R*.



General Distance Formula Derivation

- $PR = x_2 - x_1$ (difference of x-coordinates)
- $QR = y_2 - y_1$ (difference of y-coordinates)

Using Pythagoras theorem in triangle PRQ:

$$PQ^2 = PR^2 + QR^2$$
$$PQ^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

Taking square root on both sides :

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

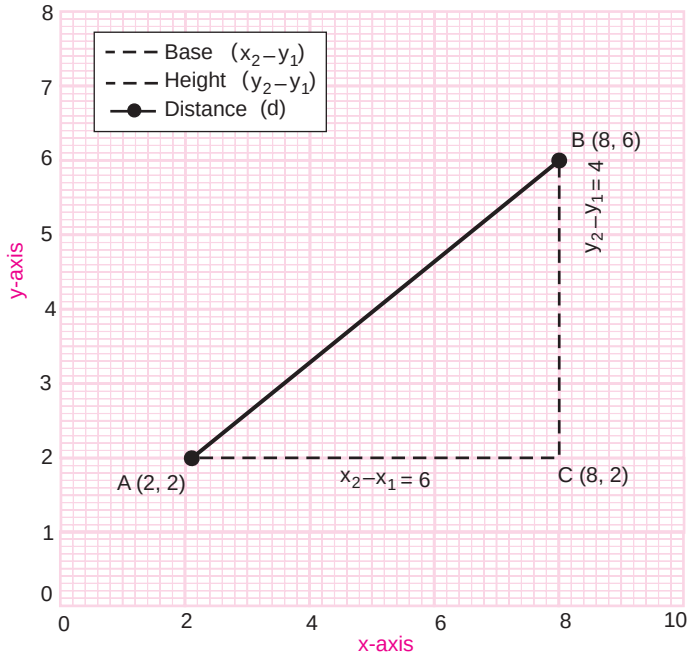
Hence, the distance between two points (x_1, y_1) and (x_2, y_2) is:

$$\boxed{d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$$

For example: Find the distance between A (2, 2) and B (8, 6).

Sol. Two points are A (2, 2) and B (8, 6).

Draw a perpendicular from point (B) to the horizontal line through point (A), meeting it at point (C). Then (triangle ACB) is a right-angled triangle at (R).



- $AC = x_2 - x_1$ (difference of x-coordinates)
- $CB = y_2 - y_1$ (difference of y-coordinates)

Using Pythagoras theorem in triangle ABC:

$$AB^2 = AC^2 + CB^2$$
$$AB^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

Taking square root on both sides :

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Put the values of x_1, x_2, y_1 and y_2.

$$AB = \sqrt{(8-2)^2 + (6-2)^2} = \sqrt{(6)^2 + (4)^2} = \sqrt{36 + 16}$$

$$AB = \sqrt{52} \text{ units.}$$

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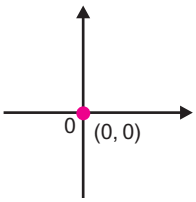
NCERT END-OF-CHAPTER EXERCISES (*Pages 12–14*)

1. ***What are the x-coordinate and y-coordinate of the point of intersection of the two axes?***

Sol. The *x*-axis and *y*-axis intersect at the origin. Hence the co-ordinates of the point of intersection are (0, 0).

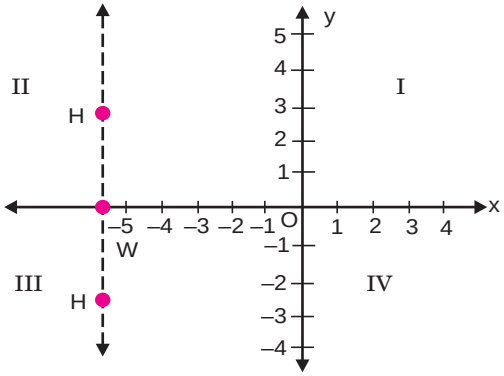


$\therefore$ *x*-coordinate = 0, *y*-coordinate = 0.

2. ***Point W has x-coordinate equal to –5. Can you predict the coordinates of point H, which is on the line through W parallel to the y-axis? Which quadrants can H lie in?***

Sol. *x*-coordinate of point *W* is –5. Then, the distance of *W* from the *y*-axis is 5 units.

Point *H* is on a line through *W* and parallel to the *y*-axis. Any point on this line has a distance of 5 units from the *y*-axis. Hence, the *x*–coordinate of *H* is also –5. However, the *y*–coordinate may be any number.



Point *H* will lie in the second or third quadrant.

3. ***Consider the points R (3, 0), A (0, – 2), M (– 5, – 2), and P (– 5, 2). If they are joined in the same order, predict:***

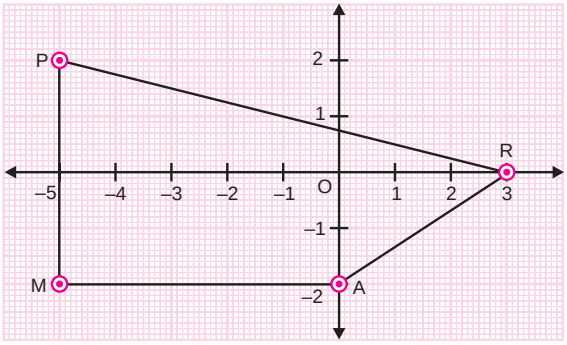
(*i*) Two sides of *RAMP* that are perpendicular to each other.

(*ii*) One side of RAMP that is parallel to one of the axes.

(*iii*) Two points that are mirror images of each other in one axis. Which axis will this be?

Now plot the points and verify your predictions.

Sol. Let us place the points on the graph, to draw a clear figure of the given points.

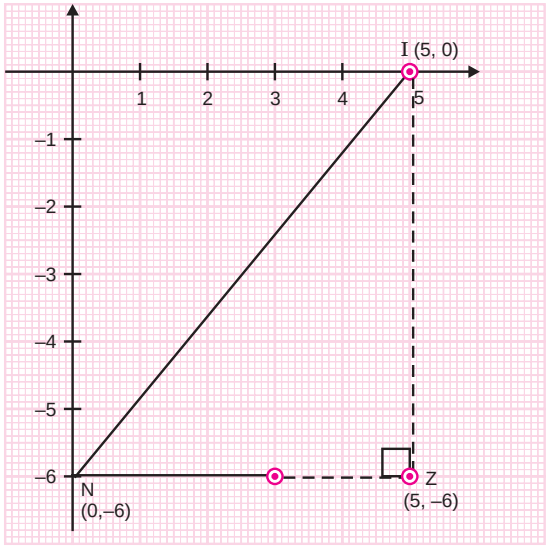


(*i*) *AM* is perpendicular to *MP*.

(*ii*) *AM* ∥ *x*-axis and *MP* ∥ *y*-axis.

(*iii*) *M* and *P* are mirror images of each other in *x*-axis. Since they have the same *x*-coordinate and opposite *y*-coordinate.

4. ***Plot point Z (5, –6) on the Cartesian plane. Construct a right-angled triangle IZN and find the lengths of the three sides. (Comment: Answers may differ from person to person.)***



Sol. **Plotting Point Z**

Point Z (5, –6) lies in the **fourth quadrant** of the Cartesian plane (+*x*, –*y*)

To form a right-angled triangle with (Z), we can drop perpendiculars to the axes:

Let's take point *I* (5, 0) on the *x*-axis directly above (*Z*).

Let's take point *N* (0, –6) on the *y*-axis directly left of (*Z*).

Thus, triangle (*IZN*) is right-angled at *Z*.

Now find the side lengths

IZ (vertical side): $IZ = 0 - (-6) = 6$

ZN (horizontal side): $ZN = 5 - 0 = 5$

IN (hypotenuse): Use the distance Formula:

$IN = \sqrt{(5-0)^2 + (0-(-6))^2}$

$IN = \sqrt{25 + 36} = \sqrt{61}$ units

$IZ = 6$ units, $ZN = 5$ units, $IN = \sqrt{61}$ units

5. ***What would a system of coordinates be like if we did not have negative numbers? Would this system allow us to locate all the points on a 2-D plane?***

Sol. If negative numbers were not used, the coordinates system would include only positive values of (x) and (y).

In such a case, we could represent only those points where $(x \geq 0)$ and $(y \geq 0)$. This region is called the **first quadrant**.

Limitation of this system :

- Points lying to the left of the *y*-axis (where $x < 0$) cannot be represented.
- Points lying below the *x*-axis (where $y < 0$) cannot be represented.

Hence, No, this system would not allow us to locate all points on a 2-D plane.

Negative numbers are necessary in a coordinate system to represent points in all four quadrants of the plane.

6.** ***Are the points M (–3, – 4), A (0, 0) and G (6, 8) on the same straight line? Suggest a method to check this without plotting and joining the points.

Sol. We will use the distance formula and check whether the sum of two distances is equal to the third.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Now, $MA = \sqrt{(0+3)^2 + (0+4)^2}$

$= \sqrt{3^2 + 4^2} = \sqrt{25} = 5$

$AG = \sqrt{(6-0)^2 + (8-0)^2}$

$= \sqrt{6^2 + 8^2} = \sqrt{100} = 10$

$MG = \sqrt{(6+3)^2 + (8+4)^2}$

$= \sqrt{9^2 + 12^2} = \sqrt{225} = 15$

Since $MA + AN = MG$.

i.e. $5 + 10 = 15$

Hence, *M*, *A* and *G* are on the same straight line.

7.** ***Use your method (from Problem 6) to check if the points R (–5, –1), B (–2, –5) and C (4, –12) are on the same straight line. Now plot both sets of points and check your answers.

Sol. Using the distance formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$RB = \sqrt{3^2 + (-4)^2} = \sqrt{25} = 5$

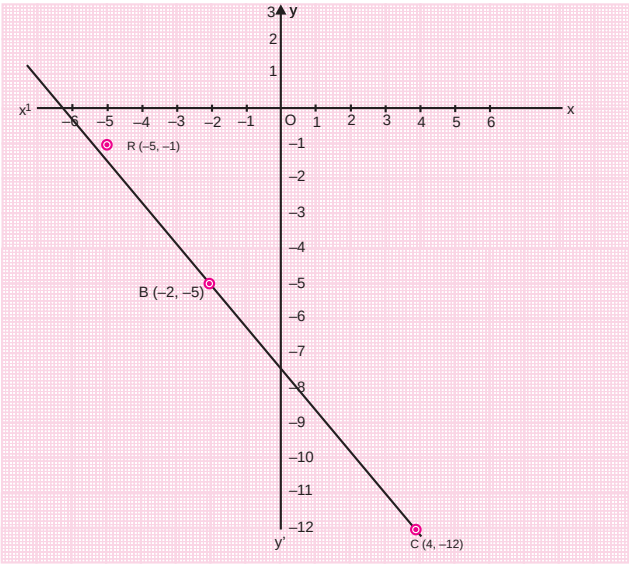
$BC = \sqrt{6^2 + (-7)^2} = \sqrt{85}$

$RC = \sqrt{9^2 + 11^2} = \sqrt{202}$

Since $RB + BC \neq RC$

i.e., $5 + \sqrt{85} \neq \sqrt{202}$

Hence, *R*, *B* and *C* are not on the same line.



* **HOTS** Questions

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8.** ***Using the origin as one vertex, plot the vertices of:

(*i*) A right-angled isosceles triangle.

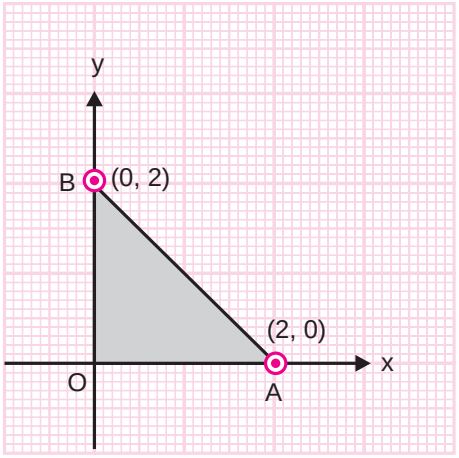
(*ii*) An isosceles triangle with one vertex in Quadrant III and the other in Quadrant IV.

Sol.

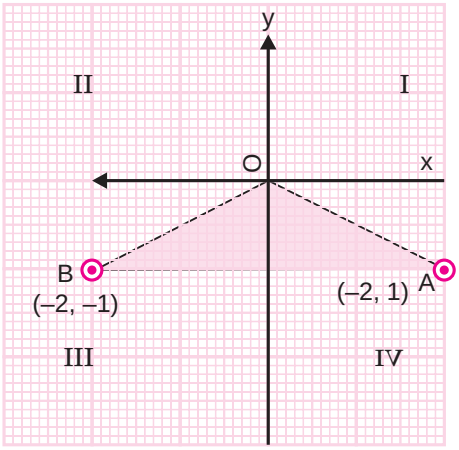
(*i*) Take one vertex at the origin (0,0). Choose the other two points at equal distances along the *x* and *y* axes. *A* (2, 0) and *B* (0, 2).

Here $OA = OB = 2$ units and $AOB = 90^\circ$

ΔAOB is a right-angled isosceles triangle.



(*ii*) Take origin O(0, 0) and *B* (–2 –1), *A* (–2 1) ΔAOB is an isosceles triangle with one vertex in quadrant III and the other in quadrant IV.



9.** ***The following table shows the coordinates of points S, M and T. In each case, state whether M is the midpoint of segment ST. Justify your answer.

S	*M*	*T*	Is *M* the midpoint of *ST*? Yes or No	Reason for your answer
(–3, 0)	(0, 0)	(3, 0)		
(2, 3)	(3, 4)	(4, 5)		
(0, 0)	(0, 5)	(0, –10)		
(–8, 7)	(0, –2)	(6, –3)		

When M is the mid-point of ST, can you find any connection between the coordinates of M, S and T?

Sol. The **midpoint** of a line segment is the point that divides the segment into two equal parts.

Let the endpoints of a line segment be :

$S(x_1, y_1)$ and $T(x_2, y_2)$

Then the midpoint *M* is given by:

$$M\left[\frac{(x_1 + x_2)}{2}, \frac{(y_1 + y_2)}{2}\right]$$

{By adding the *x*-coordinates and divide by 2 → gives *x*-coordinate of midpoint and adding the *y*-coordinates and divide by 2 → gives *y*-coordinate of midpoint}

(*i*) $\frac{-3+3}{2} = 0, \frac{0+0}{2} = 0$

Coordinates of *M* are (0, 0). Hence, *M* is the midpoint of *ST*.

(*ii*) $\frac{2+4}{2} = 3, \frac{3+5}{2} = 4$

Coordinates of *M* are (3, 4). Hence, *M* is the midpoint of *ST*.

(*iii*) $\frac{0+0}{2} = 0, \frac{0-10}{2} = -5$

Coordinates of *M* are (0, – 5). Hence, *M* is not the midpoint of *ST*.

(*iv*) $\frac{-8+6}{2} = -1, \frac{7-3}{2} = 2$

Coordinates of *M* are (– 1, 2). Hence, *M* is not the midpoint of *ST*.

Conclusion: When *M* is the midpoint of *ST* then *SM* = *MT*.

F is the midpoint of CA.

Then, $\frac{a+e}{2} = 0$, and $\frac{b+f}{2} = 3$. ...(*iii*)

Simplifying:

$a + c = 10,\ b + d = 2$ ...(*i*)

$c + e = 12,\ d + f = 10$ ...(*ii*)

$a + e = 0,\ b + f = 6$ ...(*iii*)

Adding: $2(a + c + e) = 22$

and $2(b + d + f) = 18$

Then, $a + c + e = 11$ and $b + d + f = 9$

$(a + c) + e = 11$ and $(b + d) + f = 9$

From eq. (*i*)

$10 + e = 11$ and $2 + f = 9$

$e = 11 - 10 = 1,\ f = 9 - 2 = 7$

Substituting in (*ii*)

$c + 1 = 12,\ d + 7 = 10$

$c = 12 - 1 = 11,\ d = 10 - 7 = 3.$

Substituting in (*iii*)

$a + 1 = 0,\ b + 7 = 6$

$a = 0 - 1 = -1,\ b = 6 - 7 = -1$

Hence $A(-1, -1)$, $B(11, 3)$, $C(1, 7)$.

14. ***A city has two main roads which cross each other at the centre of the city. These two roads are along the North–South (N–S) direction and East–West (E–W) direction. All the other streets of the city run parallel to these roads and are 200 m apart. There are 10 streets in each direction.***

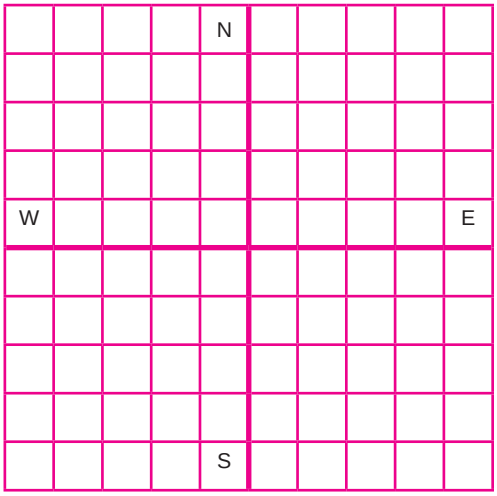
(*i*) Using 1 cm = 200 m, draw a model of the city in your notebook. Represent the roads/ streets by single lines.

(*ii*) There are street intersections in the model. Each street intersection is formed by two streets — one running in the N–S direction and another in the E–W direction. Each street intersection is referred to in the following manner: If the second street running in the N–S direction and 5th street in the E–W direction meet at some crossing, then we call this street intersection (2, 5). Using this convention, find:

(*a*) how many street intersections can be referred to as (4, 3).

(*b*) how many street intersections can be referred to as (3, 4).

Sol. Here 1 cm = 200 m.

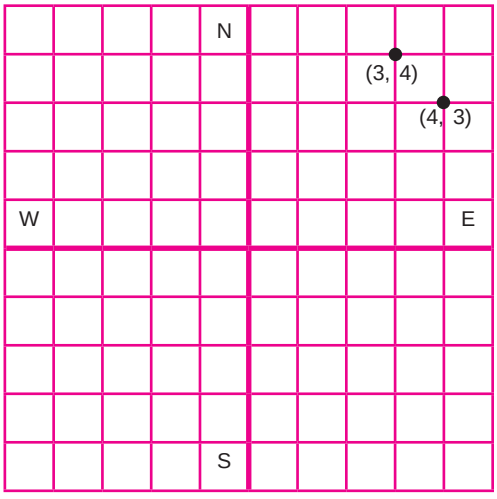


Each intersection is uniquely identified by the ordered pair (*N-S* street number, *E-W* street number).

(*a*) Intersections referred to as (4, 3)

By convention, (4, 3) means the 4th *N-S* street and the 3rd *E-W* street. This is a single intersection point.

Therefore, there is exactly 1 intersection referred to as (4, 3).



(*b*) Intersections referred to as (3, 4)

Similarly, (3, 4) means the 3rd *N-S* street and the 4th *E-W* street. Again, this is a single intersection point.

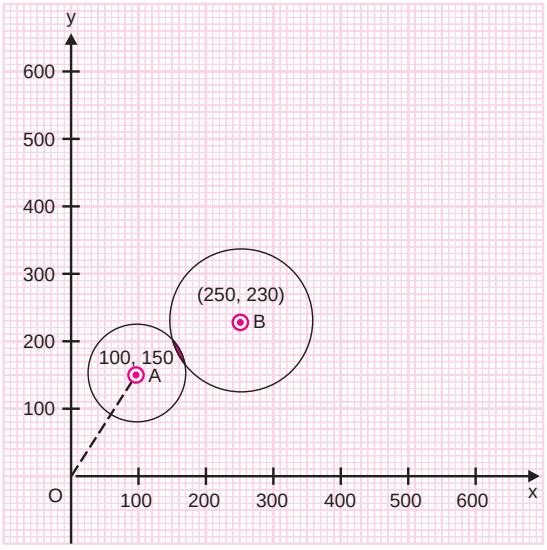
Therefore, there is exactly 1 intersection referred to as (3, 4).

15. ***A computer graphics program displays images on a rectangular screen whose coordinate system has the origin at the bottom-left corner. The screen is 800 pixels wide and 600 pixels high. A circular icon of radius 80 pixels is drawn with its centre at the point A (100, 150). Another circular icon of radius 100 pixels is drawn with its centre at the point B (250, 230). Determine:***

(*i*) whether any part of either circle lies outside the screen.

(*ii*) whether the two circles intersect each other.

Sol. (*i*)



Consider the circle with center at *A*.

Shortest distance of circle from *x*-axis (Bottom most point)

= 150 – 80 = 70 pixels

Shortest distance of circle from *y*-axis (Left most point)

= 100 – 80 = 20 pixels

Both the distances are positive. Hence, the circle lies completely in the first quadrant.

Consider the circle with center at *B*.

Shortest distance of circle from *x*-axis (Bottom most point)

= 230 – 100 = 130 pixels

Shortest distance of circle from *y*-axis (Left most point)

= 250 – 100 = 150 pixels

Both distances are positive. Hence, the circle lies completely in the first quadrant.

No part of either of the two circles lies outside the screen.

(*ii*) $AB = \sqrt{(250-100)^2 + (230-150)^2}$

$= \sqrt{22500 + 6400} = \sqrt{28900}$

= 170 pixels

$r_1 + r_2 = 80 + 100$

= 180 pixels

$r_1 + r_2 > AB$.

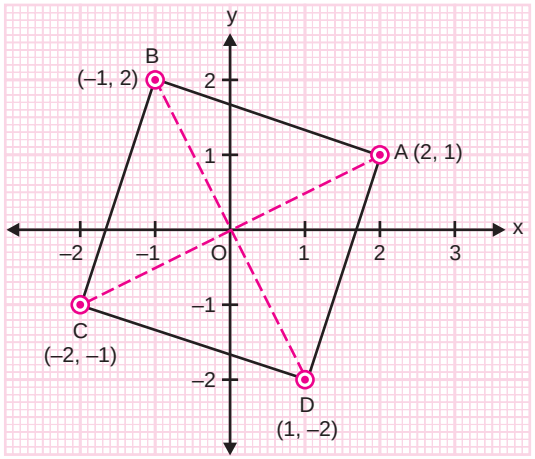
Then, circles intersect each other.

16. ***Plot the points A (2, 1), B (–1, 2), C (–2, –1), and D (1, –2) in the coordinate plane. Is ABCD a square? Can you explain why? What is the area of this square?***

Sol. Side length of quadrilateral ABCD

$AB = \sqrt{(-1-2)^2 + (2-1)^2} = \sqrt{10}$ units

$BC = \sqrt{(-2+1)^2 + (-1-2)^2} = \sqrt{10}$ units



$CD = \sqrt{(1+2)^2 + (-2+1)^2} = \sqrt{10}$ units

$DA = \sqrt{(2-1)^2 + (1+2)^2} = \sqrt{10}$ units

All sides are equal.

Then, *ABCD* is a rhombus (A quadrilateral in which all sides are equal is a rhombus)

$AC = \sqrt{(-2-2)^2 + (-1-1)^2} = \sqrt{20}$ units

$BD = \sqrt{(1+1)^2 + (-2-2)^2} = \sqrt{20}$ units

Diagonals are also equal.

Then, *ABCD* is a square. (A rhombus in which diagonals are equal is a square)

Area of square *ABCD*

$= (\sqrt{10})^2 = 10$ square units.

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EXAM CORNER

(*From Latest CBSE Examination Papers*)

A. MULTIPLE CHOICE QUESTIONS

(1 Mark each)

1. If x and y, both are positive, then the point (x, y) lies in

(a) I quadrant (b) II quadrant

(c) III quadrant (d) IV quadrant

2. If x is positive and y is negative, then the point (x, y) lies in

(a) III quadrant (b) IV quadrant

(c) II quadrant (d) I quadrant

3. The line of intersection of II and III quadrants is

(a) x-axis (b) y-axis

(c) vertical axis (d) none of these

4. The line of intersection of III and IV quadrants is

(a) y-axis (b) x-axis

(c) horizontal axis (d) none of these

5. The line of intersection of IV and I quadrants is

(a) x-axis (b) y-axis

(c) vertical axis (d) none of these

6. Where do the II and IV quadrants meet?

(a) at O (b) in y-axis

(c) in x-axis (d) do not intersect

7. Where do the four quadrants meet?

(a) at O (b) in x-axis

(c) in y-axis (d) do not meet

8. In fourth quadrant, x is

(a) +ve (b) –ve

(c) 0 (d) none of these

9. In fourth quadrant, y is

(a) –ve (b) +ve

(c) 0 (d) none of these

10. The points (–5, 2) and (2, –5) lie in the:

(a) Same quadrant

(b) II and III quadrants respectively

(c) II and IV quadrants respectively

(d) IV and III quadrants respectively [*CBSE*]

11. Abscissa of a point is positive in:

(a) I and II quadrants (b) I and IV quadrants

(c) I quadrant only (d) IV quadrant only

[*CBSE*]

12. In which quadrant does the point (–1, 2) lie?

(a) I (b) II

(c) III (d) IV

13. In which quadrant does the point (–1, –1) lie?

(a) I (b) II

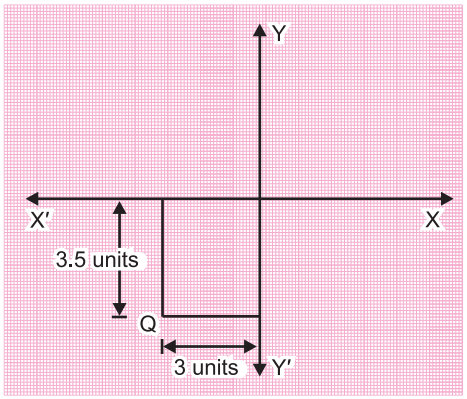
(c) III (d) IV

14. In which quadrant does the point (1, –2) lie?

(a) I (b) II

(c) III (d) IV

15. The co-ordinates of point Q are:



(a) (3, 3.5) (b) (3.5, 3)

(c) (– 3, 3.5) (d) (– 3, – 3.5) [*CBSE*]

16. If the points A(2, 0), B(– 6, 0) and C(3, a – 3) lie on the x-axis, then the value of a is :

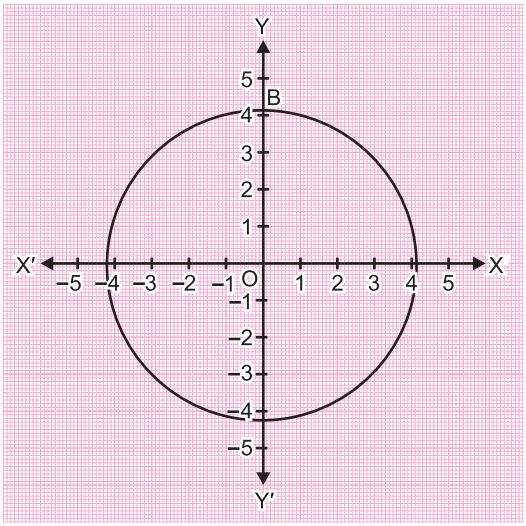
(a) 0 (b) 2

(c) 3 (d) –6 [*CBSE*]

C. SHORT ANSWER TYPE QUESTIONS

(3 Marks each)

1. In the given figure of a circle, write the coordinates of the points where circle meets the axes. [CBSE]



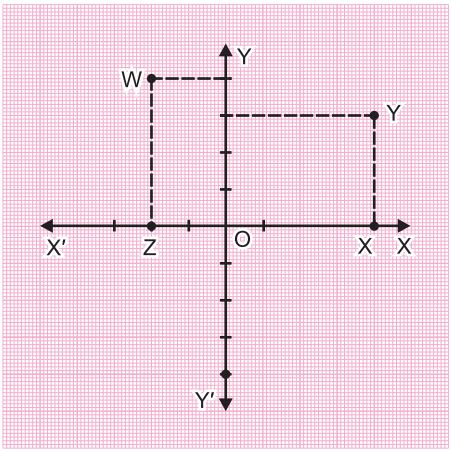
2. Write coordinates of two points on x-axis and two points on y-axis which are at equal distances from the origin. [CBSE]

3. If the coordinates of two points are P(– 2, 3) and Q(– 3, 5), then find

(abscissa of P) – (abscissa of Q). [CBSE]

4. Plot the point P(– 5, 1) and from it draw PM and PN perpendiculars to x-axis and y-axis respectively. Write the coordinates of M and N. [CBSE]

5. Write the coordinates of the points X, Y, Z and W from the figure: [CBSE]



6. With the help of distance formula, show that the points A(4, 2), B(7, 5) and C(9, 7) do not form a triangle. [CBSE]

7. If the point P(k –1, 2) is equidistant from the points A(3, k) and B(k, 5), find the values of k. [CBSE]

8. The coordinates of the vertices of Δ ABC are A(7, 2), B(9, 10) and C(1, 4). If E and F are the mid-points of AB and AC respectively, prove that EF = $\frac{1}{2}$ BC. [CBSE]

9. If the point (x, y) is equidistant from the points ($a - b$, $a + b$) and ($a + b$, $a + b$), prove that $x - a = 0$. [CBSE]

Solutions

1. Let the circle meet OX at A and OX′ at A′. Then,

A → (4, 0)

A′ → (– 4, 0)

Let the circle meet OY at B and OY′ at B′. Then,

B → (0, 4)

B′ → (0, – 4)

2. The coordinates of two points on x-axis which are at equal distances from the origin can be taken as (1, 0) and (– 1, 0).

The coordinates of two points on y-axis which are at equal distances from the origin can be taken as (0, 1) and (0, – 1).

3. (abscissa of P) – (abscissa of Q)

= (– 2) – (– 3) = – 2 + 3 = 1

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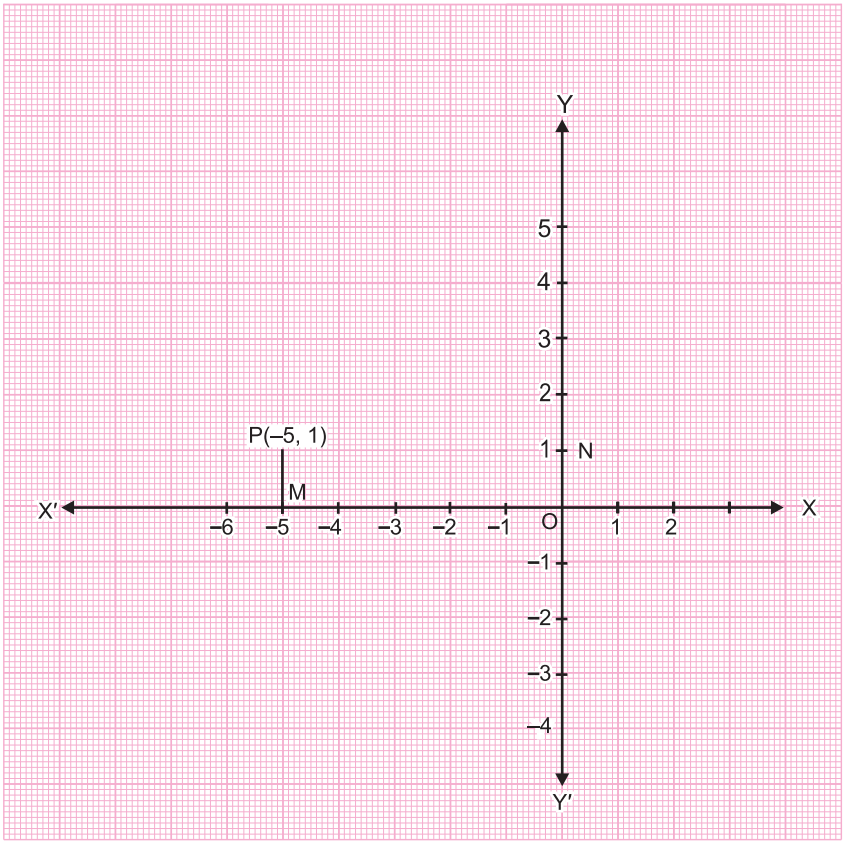
4.



$M \rightarrow (-5, 0)$

$N \rightarrow (0, 1)$

5. $X \rightarrow (4, 0)$

$Y \rightarrow (4, 3)$

$Z \rightarrow (-2, 0)$

$W \rightarrow (-2, 4)$

6. We have,

$A \rightarrow (4, 2)$

$B \rightarrow (7, 5)$

$C \rightarrow (9, 7)$

Using distance formula,

$$AB = \sqrt{(7-4)^2 + (5-2)^2}$$

$$= \sqrt{(3)^2 + (3)^2}$$

$$= \sqrt{9+9} = \sqrt{18}$$

$$= \sqrt{9 \times 2} = 3\sqrt{2}$$

$$BC = \sqrt{(9-7)^2 + (7-5)^2}$$

$$= \sqrt{4+4} = \sqrt{8}$$

$$= \sqrt{4 \times 2} = 2\sqrt{2}$$

and

$$CA = \sqrt{(4-9)^2 + (2-7)^2}$$

$$= \sqrt{(-5)^2 + (-5)^2}$$

$$= \sqrt{25+25} = \sqrt{50}$$

$$= \sqrt{25 \times 2} = 5\sqrt{2}$$

We find that

$$AB + BC = 3\sqrt{2} + 2\sqrt{2}$$

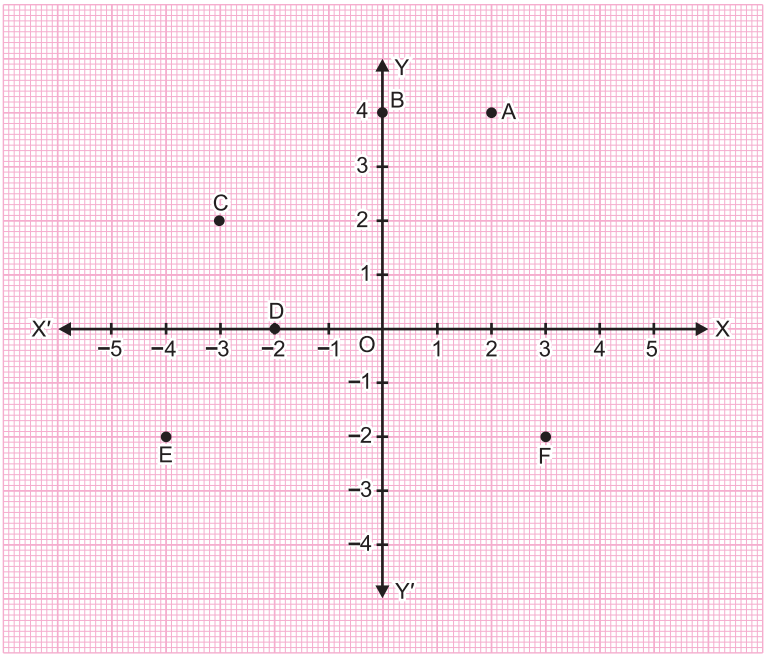
$$= (3+2)\sqrt{2}$$

$$= 5\sqrt{2} = CA$$

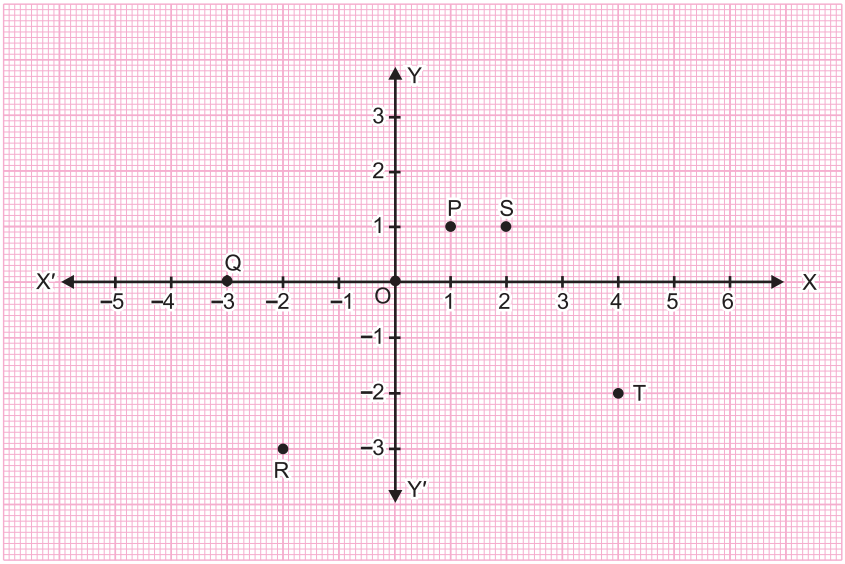
D. LONG ANSWER TYPE QUESTIONS

(5 Marks each)

1. Write the coordinates of the points A, B, C, D, E and F in the following graph. [*CBSE*]



2. Write the coordinates of each of the points P, Q, R, S, T and O from the adjoining figure. [*CBSE*]



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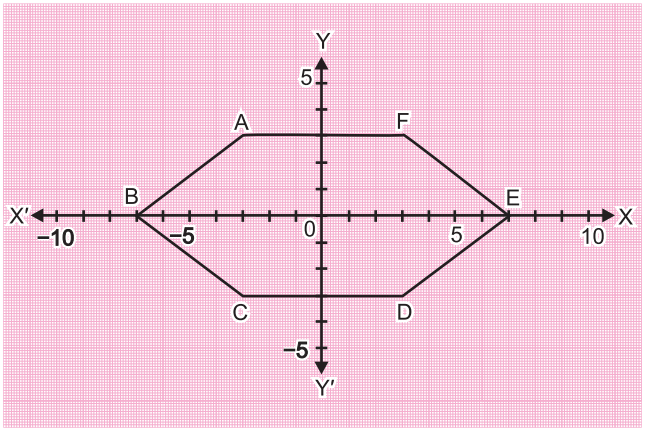
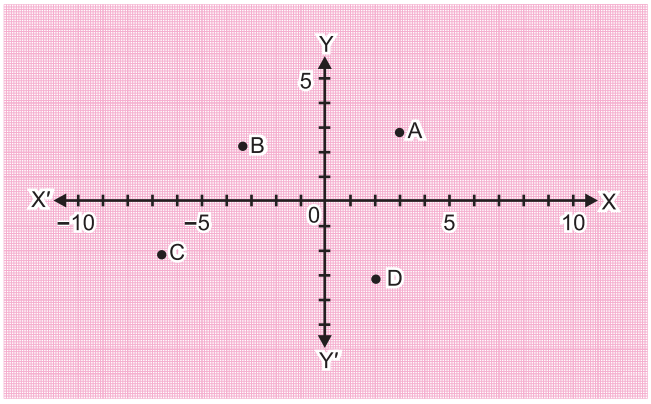
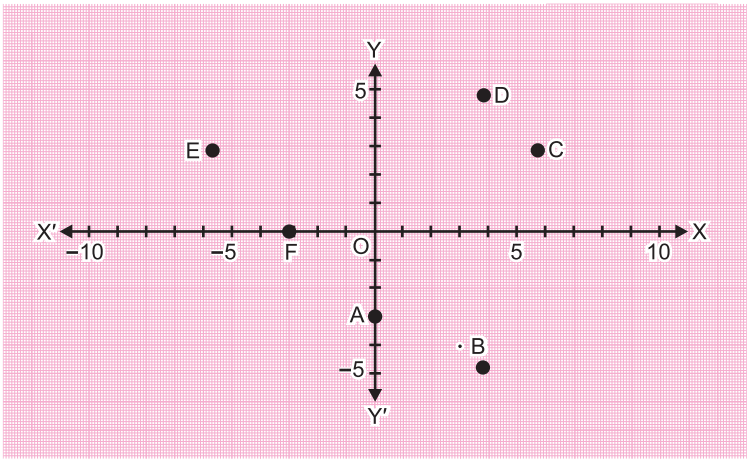
3. Write coordinates of points A, B, C, D, E and F of figure formed on the graph. Also, write coordinates of points of intersection of AC and DF with *x*-axis. [*CBSE*]



4. Write the coordinates of the points A, B, C and D from the graph. Give points of reflection of A and C in *x*-axis. Also, give points of reflection of B and D in *y*-axis. [*CBSE*]



5. From the graph, find the coordinates of the points A, B, C, D, E and F. Which points have same abscissas? Also, find which points have same ordinates. [*CBSE*]



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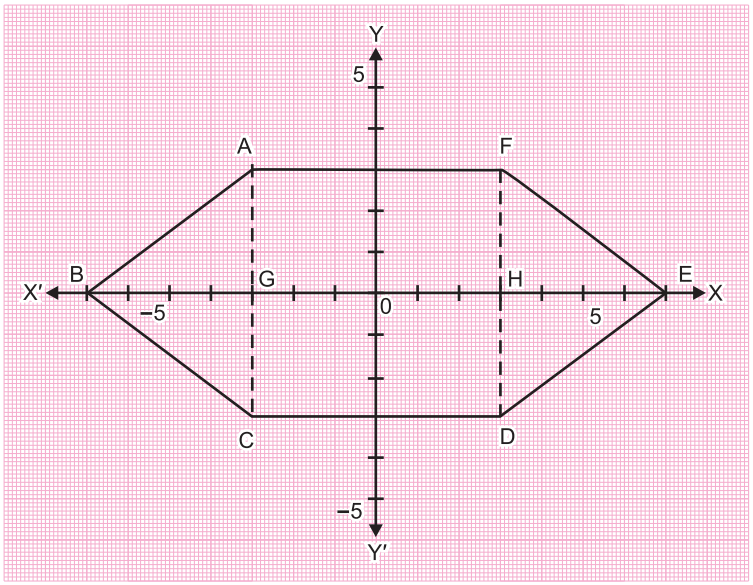
Solutions

1. A → (2, 4) B → (0, 4) C → (– 3, 2) D → (– 2, 0)
E → (– 4, – 2) F → (3, – 2)

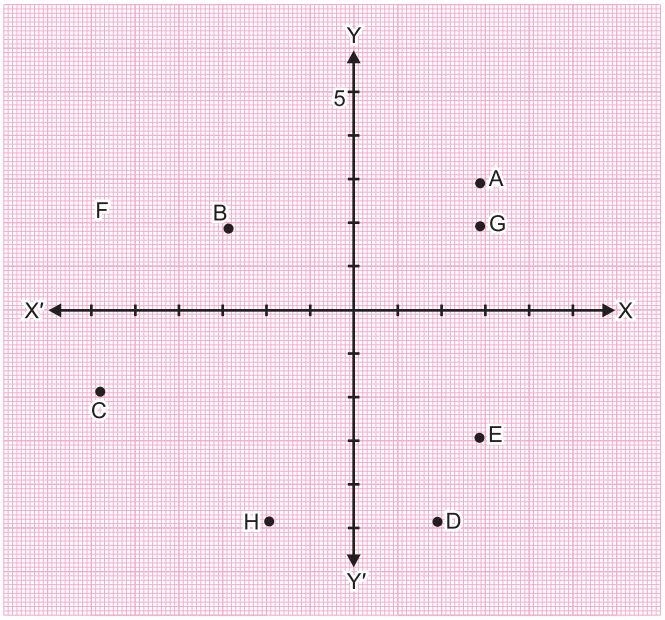
2. O → (0, 0) P → (1, 1) Q → (– 3, 0) R → (– 2, – 3)
S → (2, 1) T → (4, – 2)

3.



A → (– 3, 3) B → (– 7, 0) C → (– 3, – 3) D → (3, – 3)
E → (7, 0) F → (3, 3)
Coordinates of point of intersection G of AC with x-axis = (– 3, 0)
Coordinates of point of intersection H of DF with x-axis = (3, 0)

4. A → (3, 3) B → (– 3, 2) C → (– 6, – 2) D → (2, – 5)



Reflection of A in x-axis = E(3, – 3) Reflection of B in y-axis = G(3, 2)

Reflection of C in x-axis = F(– 6, 2) Reflection of D in y-axis = H(– 2, – 5)

5. A → (0, – 3) D → (4, 5)

B → (4, – 5) E → (– 6, 3)

C → (6, 3) F → (– 3, 0)

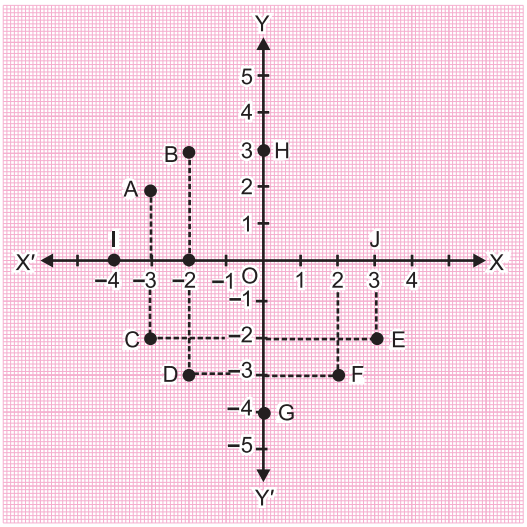
The points B and D have same abscissae.

The points C and E have same ordinates.

E. CASE STUDY BASED QUESTIONS

(4 Marks each)

1. *Observe the graph below and answer the questions that follow :*



(*i*) In the above figure, coordinates of points in second quadrant are

(*a*) (– 3, 2) and (– 2, 3)

(*b*) (3, 2) and (2, 3)

(*c*) (3, – 2) and (2, – 3)

(*d*) (– 3, – 2) and (– 2, – 3)

(*ii*) In the above figure, coordinates of points in third quadrant are

(*a*) (– 3, 2) and (– 2, 3)

(*b*) (3, 2) and (2, 3)

(*c*) (3, – 2) and (2, – 3)

(*d*) (– 3, – 2) and (– 2, – 3)

(*iii*) In the above figure, coordinates of points in fourth quadrant are

(*a*) (– 3, 2) and (– 2, 3)

(*b*) (3, 2) and (2, 3)

(*c*) (3, – 2) and (2, – 3)

(*d*) (– 3, – 2) and (– 2, – 3)

(*iv*) In the above figure, coordinates of points on y-axis are

(*a*) (– 4, 0) and (3, 0)

(*b*) (4, 0) and (– 3, 0)

(*c*) (0, – 4) and (0, 3)

(*d*) (0, 4) and (0, – 3)

(*v*) In the above figure, coordinates of points on x-axis are

(*a*) (– 4, 0) and (3, 0) (*b*) (4, 0) and (– 3, 0)

(*c*) (0, – 4) and (0, 3) (*d*) (0, 4) and (0, – 3)

ANSWERS

1. (*i*) *a* (*ii*) *d* (*iii*) *c*

(*iv*) *c* (*v*) *a*

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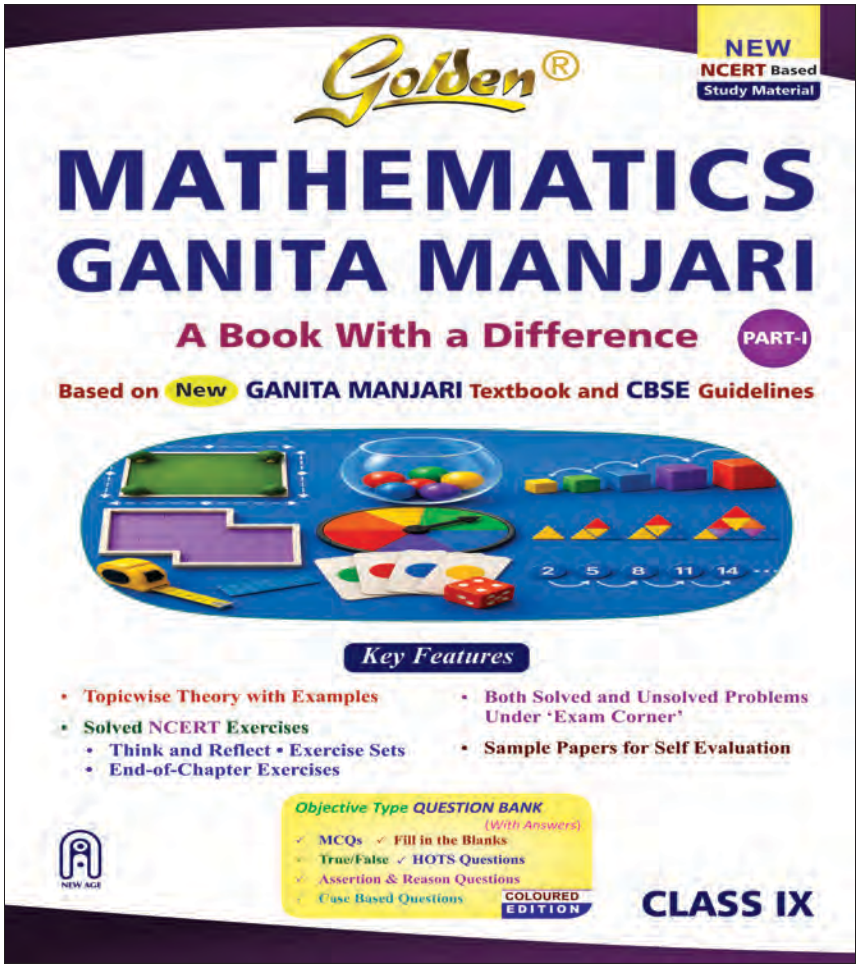

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